Pantheon Report

Generated at 2018-09-06 01:51:15 (UTC).

Data path: GCE Sydney on `ens4` (*local*) →GCE Tokyo on `ens4` (*remote*).

Repeated the test of 4 congestion control schemes twice.

Each test lasted for 30 seconds running 3 flows with 10-second interval between two flows.

NTP offsets were measured against `time.google.com` and have been applied to correct the timestamps in logs.

```
System info:
Linux 4.15.0-1018-gcp
net.core.default_qdisc = fq
net.core.rmem_default = 16777216
net.core.rmem_max = 536870912
net.core.wmem_default = 16777216
net.core.wmem_max = 536870912
net.ipv4.tcp_rmem = 4096 16777216 536870912
net.ipv4.tcp_wmem = 4096 16777216 536870912
net.ipv4.tcp_mem = 536870912 536870912 536870912
```
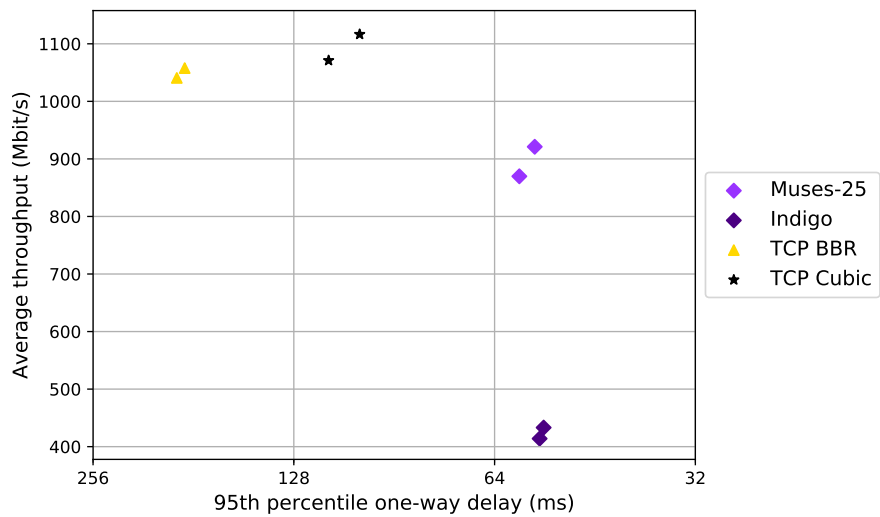
```
Git summary:
branch: muses @ 18b9165265c8ba2915c862e8713fd9ad82c1ac21
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdfe58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/muses @ a28d20fb82a95a965a3da65fd1eb71b8994e9b84
third_party/pantheon-tunnel @ cbfce6db5ff5740dafe1771f813cd646339e1952
third_party/pcc @ 1afc958fa0d66d18b623c091a55fec872b4981e1
 M receiver/src/buffer.h
 M receiver/src/core.cpp
 M sender/src/buffer.h
 M sender/src/core.cpp
third_party/pcc-experimental @ cd43e34e3f5f5613e8acd08fab92c4eb24f974ab
third_party/proto-quic @ 77961f1a82733a86b42f1bc8143ebc978f3cff42
third_party/scream-reproduce @ f099118d1421aa3131bf11ff1964974e1da3bdb2
 M src/ScreamClient
 M src/ScreamServer
third_party/sprout @ 366e35c6178b01e31d4a46ad18c74f9415f19a26
third_party/verus @ d4b447ea74c6c60a261149af2629562939f9a494
 M src/verus.hpp
 M tools/plot.py
third_party/vivace @ 2baf86211435ae071a32f96b7d8c504587f5d7f4
third_party/webrtc @ 3f0cc2a9061a41b6f9dde4735770d143a1fa2851
```

test from GCE Sydney to GCE Tokyo, 2 runs of 30s each per scheme
3 flows with 10s interval between flows (mean of all runs by scheme)

test from GCE Sydney to GCE Tokyo, 2 runs of 30s each per scheme
3 flows with 10s interval between flows

2

scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	2	547.25	510.54	488.09	170.22	206.75	149.78	1.62	3.25	1.02
TCP Cubic	2	587.95	542.99	433.87	109.56	113.30	91.65	0.09	0.12	0.00
Indigo	2	225.94	208.19	183.90	53.16	54.89	53.43	0.00	0.00	0.00
Muses-25	2	491.65	430.08	363.12	58.41	56.06	55.31	0.00	0.00	0.00

```
Run 1: Statistics of TCP BBR

Start at: 2018-09-06 01:17:36
End at: 2018-09-06 01:18:06
Local clock offset: 0.133 ms
Remote clock offset: 0.067 ms


# Below is generated by plot.py at 2018-09-06 01:50:58
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1040.74 Mbit/s
95th percentile per-packet one-way delay: 191.715 ms
Loss rate: 1.81%
-- Flow 1:
Average throughput: 556.10 Mbit/s
95th percentile per-packet one-way delay: 156.993 ms
Loss rate: 1.37%
-- Flow 2:
Average throughput: 491.08 Mbit/s
95th percentile per-packet one-way delay: 214.575 ms
Loss rate: 2.43%
-- Flow 3:
Average throughput: 474.92 Mbit/s
95th percentile per-packet one-way delay: 186.922 ms
Loss rate: 2.05%
```
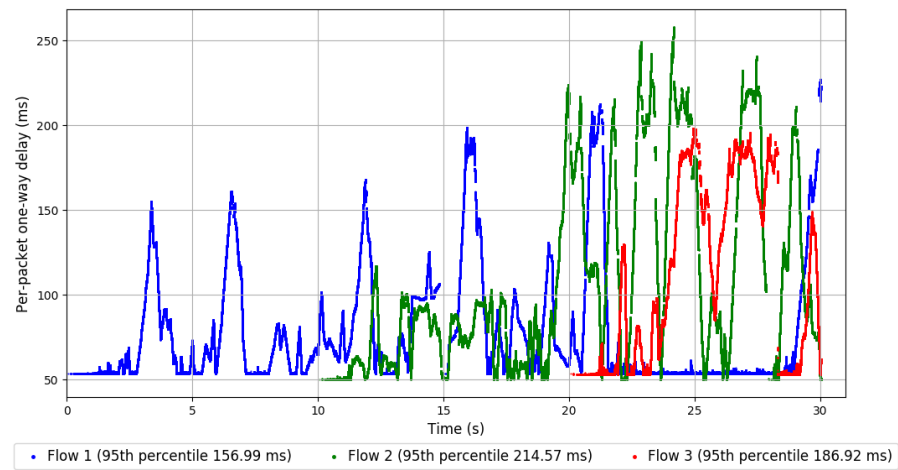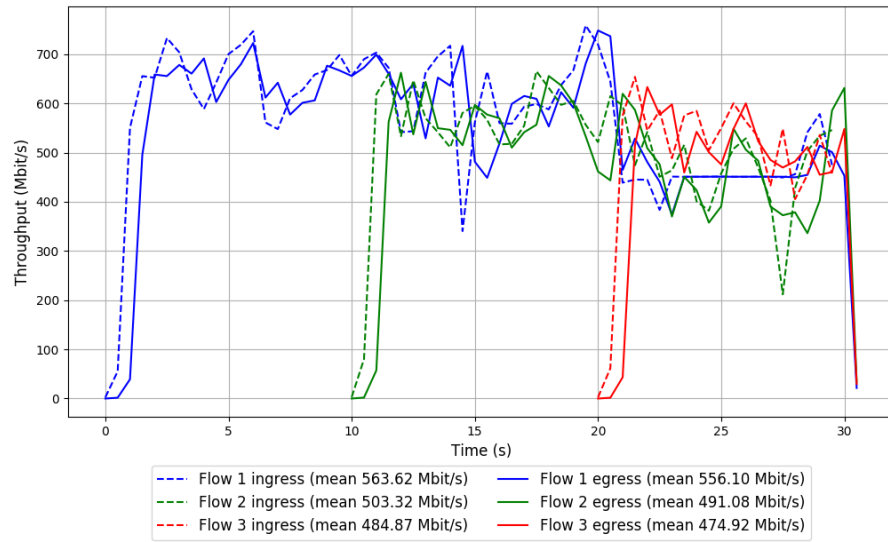
Run 1: Report of TCP BBR — Data Link

```
Run 2: Statistics of TCP BBR

Start at: 2018-09-06 01:25:32
End at: 2018-09-06 01:26:02
Local clock offset: 0.412 ms
Remote clock offset: 0.227 ms


# Below is generated by plot.py at 2018-09-06 01:51:02
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1057.82 Mbit/s
95th percentile per-packet one-way delay: 186.571 ms
Loss rate: 2.33%
-- Flow 1:
Average throughput: 538.41 Mbit/s
95th percentile per-packet one-way delay: 183.457 ms
Loss rate: 1.86%
-- Flow 2:
Average throughput: 530.00 Mbit/s
95th percentile per-packet one-way delay: 198.932 ms
Loss rate: 4.08%
-- Flow 3:
Average throughput: 501.25 Mbit/s
95th percentile per-packet one-way delay: 112.629 ms
Loss rate: 0.00%
```
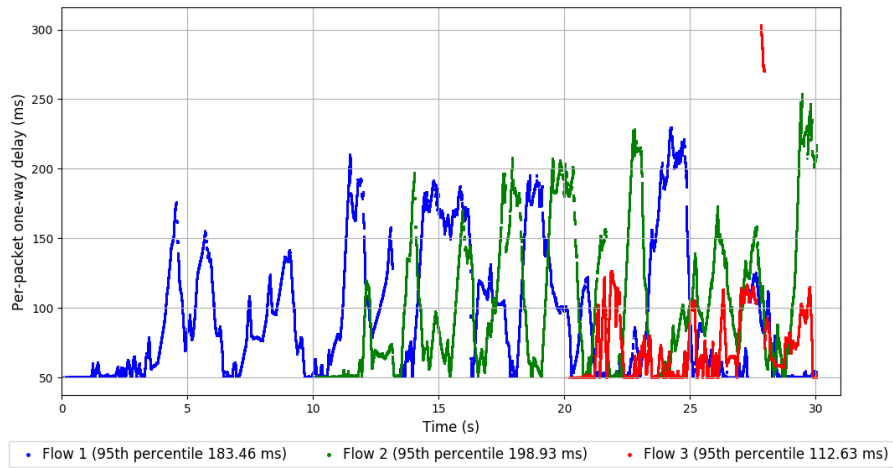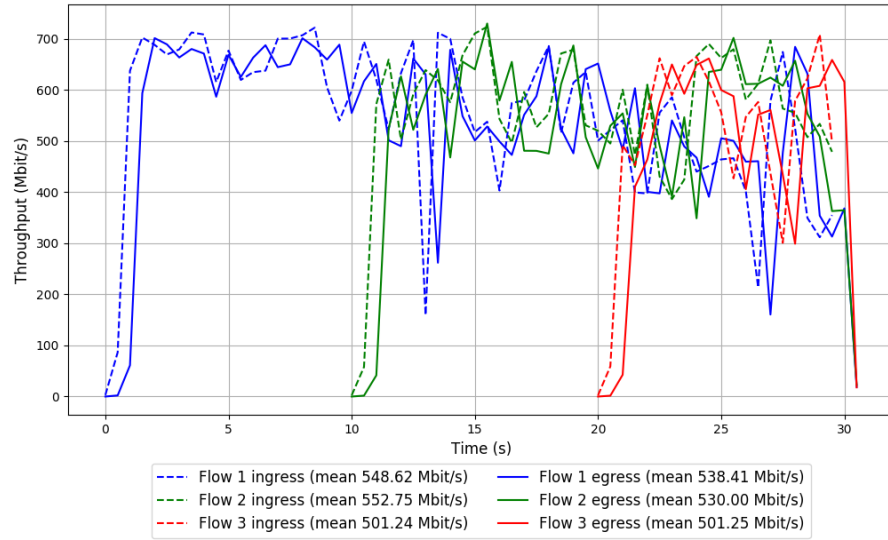
Run 2: Report of TCP BBR — Data Link

```
Run 1: Statistics of TCP Cubic

Start at: 2018-09-06 01:19:44
End at: 2018-09-06 01:20:14
Local clock offset: 0.275 ms
Remote clock offset: 0.114 ms


# Below is generated by plot.py at 2018-09-06 01:51:06
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1071.00 Mbit/s
95th percentile per-packet one-way delay: 113.517 ms
Loss rate: 0.09%
-- Flow 1:
Average throughput: 561.99 Mbit/s
95th percentile per-packet one-way delay: 114.716 ms
Loss rate: 0.08%
-- Flow 2:
Average throughput: 549.01 Mbit/s
95th percentile per-packet one-way delay: 127.617 ms
Loss rate: 0.13%
-- Flow 3:
Average throughput: 431.43 Mbit/s
95th percentile per-packet one-way delay: 90.307 ms
Loss rate: 0.00%
```
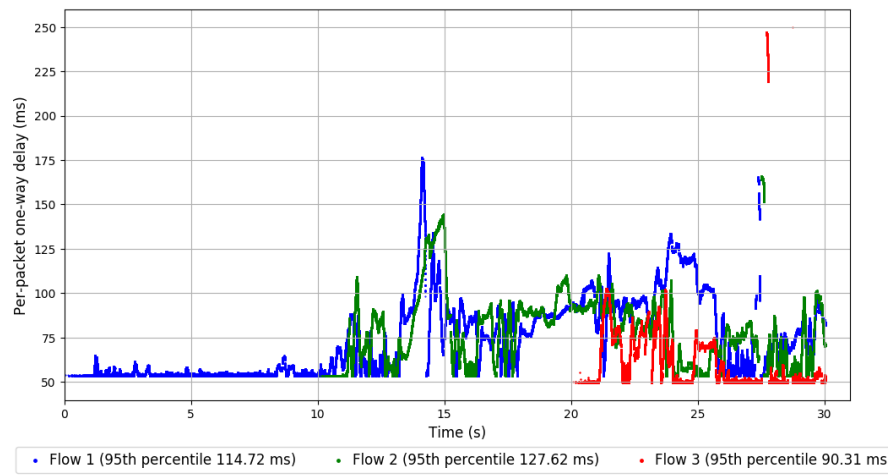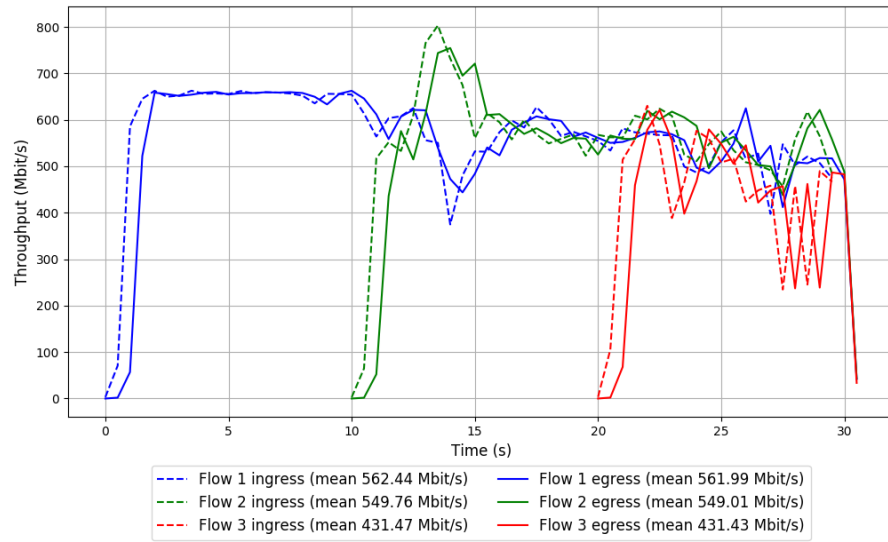
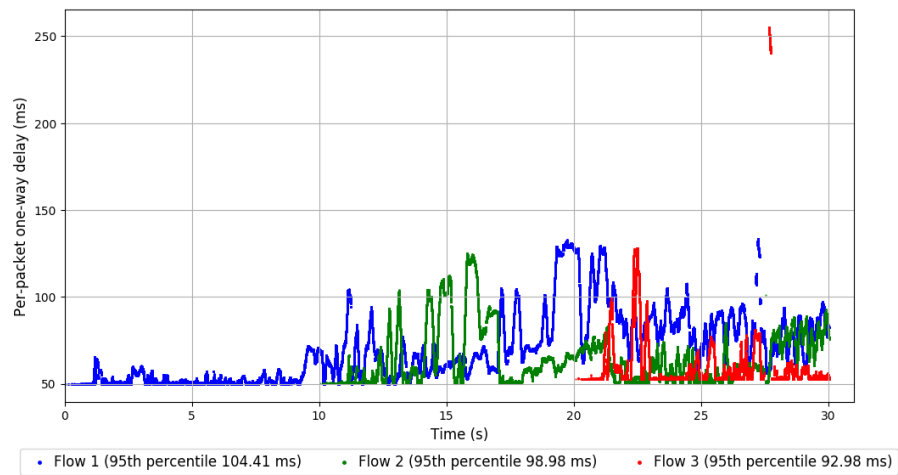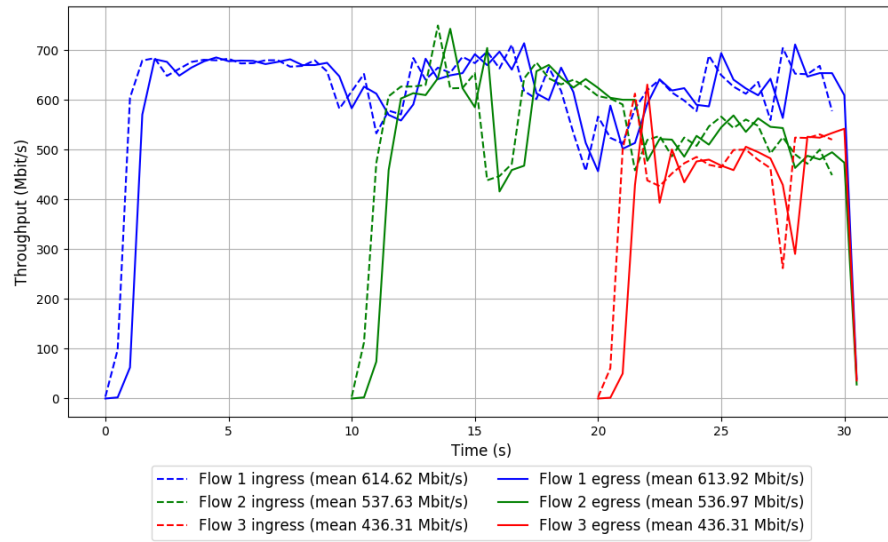Run 1: Report of TCP Cubic — Data Link

9

```
Run 2: Statistics of TCP Cubic

Start at: 2018-09-06 01:27:41
End at: 2018-09-06 01:28:11
Local clock offset: 0.098 ms
Remote clock offset: -0.119 ms


# Below is generated by plot.py at 2018-09-06 01:51:13
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1116.50 Mbit/s
95th percentile per-packet one-way delay: 101.983 ms
Loss rate: 0.09%
-- Flow 1:
Average throughput: 613.92 Mbit/s
95th percentile per-packet one-way delay: 104.410 ms
Loss rate: 0.10%
-- Flow 2:
Average throughput: 536.97 Mbit/s
95th percentile per-packet one-way delay: 98.983 ms
Loss rate: 0.10%
-- Flow 3:
Average throughput: 436.31 Mbit/s
95th percentile per-packet one-way delay: 92.983 ms
Loss rate: 0.00%
```

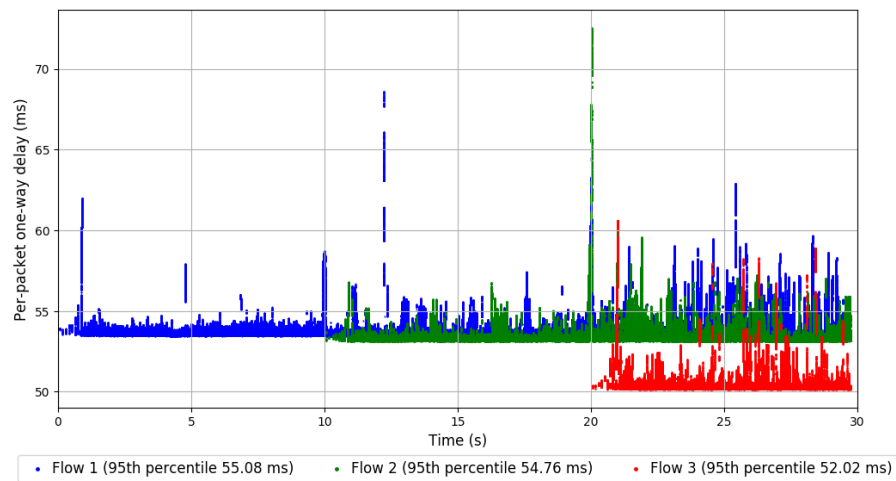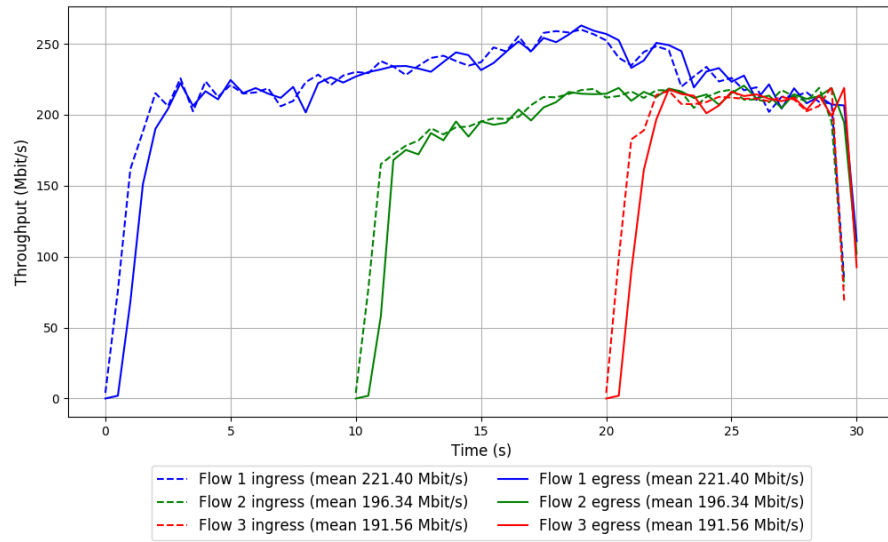Run 2: Report of TCP Cubic — Data Link

```
Run 1: Statistics of Indigo

Start at: 2018-09-06 01:23:42
End at: 2018-09-06 01:24:12
Local clock offset: 0.34 ms
Remote clock offset: 0.282 ms


# Below is generated by plot.py at 2018-09-06 01:51:13
# Datalink statistics
-- Total of 3 flows:
Average throughput: 413.98 Mbit/s
95th percentile per-packet one-way delay: 54.783 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 221.40 Mbit/s
95th percentile per-packet one-way delay: 55.082 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 196.34 Mbit/s
95th percentile per-packet one-way delay: 54.762 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 191.56 Mbit/s
95th percentile per-packet one-way delay: 52.016 ms
Loss rate: 0.00%
```

Run 1: Report of Indigo — Data Link

```
Run 2: Statistics of Indigo

Start at: 2018-09-06 01:31:40
End at: 2018-09-06 01:32:10
Local clock offset: 0.166 ms
Remote clock offset: -0.1 ms


# Below is generated by plot.py at 2018-09-06 01:51:13
# Datalink statistics
-- Total of 3 flows:
Average throughput: 433.14 Mbit/s
95th percentile per-packet one-way delay: 54.028 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 230.49 Mbit/s
95th percentile per-packet one-way delay: 51.238 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 220.05 Mbit/s
95th percentile per-packet one-way delay: 55.013 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 176.24 Mbit/s
95th percentile per-packet one-way delay: 54.839 ms
Loss rate: 0.00%
```
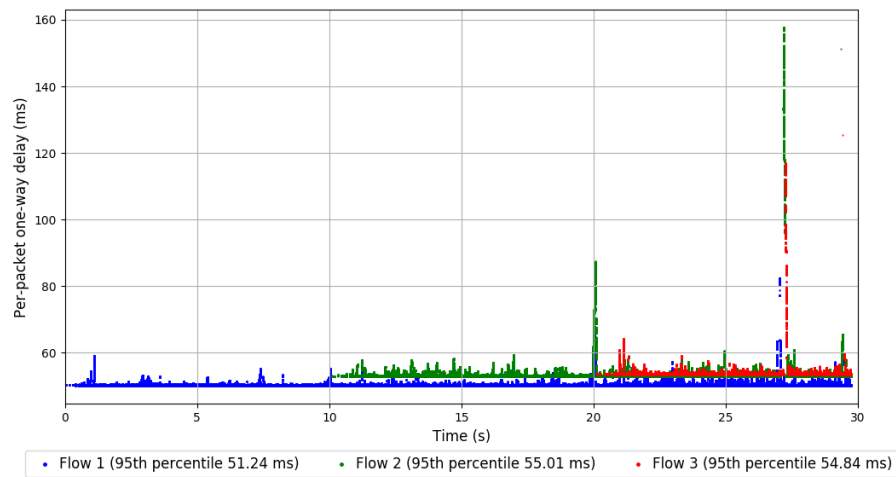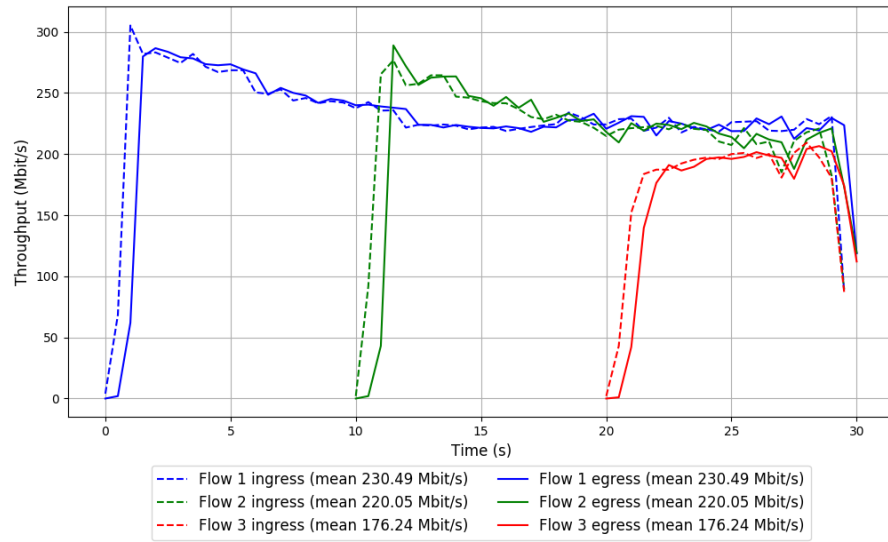
Run 2: Report of Indigo — Data Link

Flow 1 ingress (mean 230.49 Mbit/s) — — — Flow 1 egress (mean 230.49 Mbit/s)
Flow 2 ingress (mean 220.05 Mbit/s) — — — Flow 2 egress (mean 220.05 Mbit/s)
Flow 3 ingress (mean 176.24 Mbit/s) — — — Flow 3 egress (mean 176.24 Mbit/s)

Flow 1 (95th percentile 51.24 ms)   Flow 2 (95th percentile 55.01 ms)   Flow 3 (95th percentile 54.84 ms)
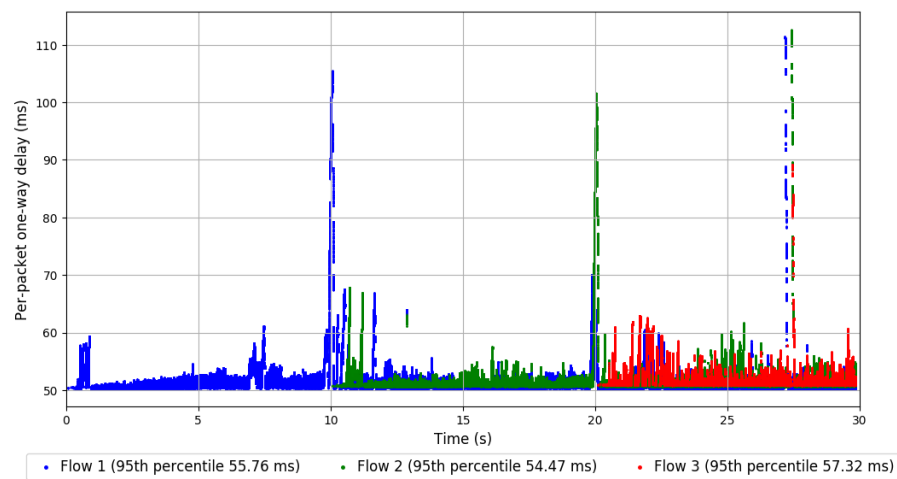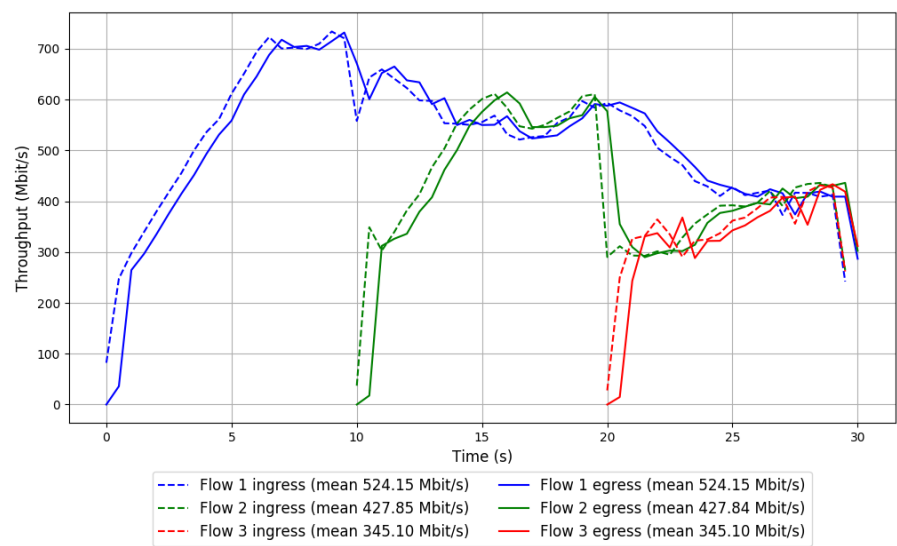
```
Run 1: Statistics of Muses-25

Start at: 2018-09-06 01:21:47
End at: 2018-09-06 01:22:17
Local clock offset: 0.064 ms
Remote clock offset: 0.229 ms


# Below is generated by plot.py at 2018-09-06 01:51:13
# Datalink statistics
-- Total of 3 flows:
Average throughput: 921.11 Mbit/s
95th percentile per-packet one-way delay: 55.717 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 524.15 Mbit/s
95th percentile per-packet one-way delay: 55.756 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 427.84 Mbit/s
95th percentile per-packet one-way delay: 54.472 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 345.10 Mbit/s
95th percentile per-packet one-way delay: 57.319 ms
Loss rate: 0.00%
```

Run 1: Report of Muses-25 — Data Link

```
Run 2: Statistics of Muses-25

Start at: 2018-09-06 01:29:47
End at: 2018-09-06 01:30:17
Local clock offset: 0.025 ms
Remote clock offset: -0.617 ms


# Below is generated by plot.py at 2018-09-06 01:51:13
# Datalink statistics
-- Total of 3 flows:
Average throughput: 869.77 Mbit/s
95th percentile per-packet one-way delay: 58.757 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 459.15 Mbit/s
95th percentile per-packet one-way delay: 61.060 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 432.32 Mbit/s
95th percentile per-packet one-way delay: 57.653 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 381.15 Mbit/s
95th percentile per-packet one-way delay: 53.305 ms
Loss rate: 0.00%
```

Run 2: Report of Muses-25 — Data Link